

## EXECUTIVE SUMMARY

The Mahoning River Environmental Dredging Reconnaissance Study addresses problems and opportunities for ecosystem restoration related to contaminated sediments in the lower Mahoning River, located in northeastern Ohio.

This reconnaissance level study was conducted by the United States Army Corps of Engineers (USACE, or the "Corps"), Pittsburgh District, pursuant to Section 312 of the Water Resources Development Act of 1990, as amended by Section 205 of the Water Resources Development Act of 1996. The amended Section 312 provides for the removal of contaminated sediments (dredging) within "navigable waters" (referring to Corps jurisdictional authority) for the purpose of ecosystem restoration, if such removal was requested by a non-federal sponsor, and if that sponsor has agreed to pay 50 percent of the cost of removal and remediation and 100 percent of the cost of disposal. Planning for this project is to be conducted in two phases: a reconnaissance phase and a cost-shared feasibility phase. This report summarizes the activities and findings of the reconnaissance phase study.

The purpose of this study is to identify problems and opportunities for ecosystem restoration that would be in the Federal interest, are supported by a local sponsor willing to cost share in a more detailed feasibility study and eventual project implementation. Work for this study included an evaluation of existing technical and historical data, the collection of new data where data gaps were found to exist, and the analysis of all such data pursuant to the purpose stated above. Local involvement in the study process was accomplished by the establishment of an ad hoc steering committee of governmental, academic, and private entities interested in the restoration of the Mahoning River. Coordination with this group by the Corps was maintained throughout the study process. This coordination included four general meetings; two meetings with members of this group to discuss technical issues associated with sampling and testing of river sediments; one meeting with potential funding sources; and numerous phone and electronic communications. The study

objectives developed in coordination with this steering committee early in the study process were to **"Restore the aquatic ecosystem and biotic integrity of the Mahoning River within the project area to a level existing on a model reach on the Mahoning River just upstream of the proposed project area, and to eliminate the Ohio Department of Health Human Health Advisory (HHA) currently in effect. "** The HHA currently in effect along the lower 28 miles of the Mahoning River in Ohio area consists of two warnings, one cautioning against "contact" with sediments in the river and another restricting fish consumption.

The proposed project area determined by this study includes approximately 31 miles of the lower Mahoning River from Warren, Ohio (River Mile 42.9)<sup>1</sup>, which is 1.9 miles upstream from the limit of Navigational Servitude, to the Ohio-Pennsylvania border (River Mile 12). There are nine low-head water-supply dams in the project area, only a few of which are in use. The project area had been identified in previous reports as being moderately to severely impaired due to contaminated sediments, both within the main channel and along bank areas, originating from historical industrial activity along the river. Much of the project area is included in the HHA. The model reach of the Mahoning River selected by this study is just upstream of the project area between r.m. 43.3 and 45.5 and supports healthy, desirable aquatic life communities, represents a biological standard well worth replicating in the project area, and is not subject to any HHA conditions. Furthermore, the model reach currently meets or has the potential to meet the goals of the Clean Water Act (CWA) relating to fishable and swimmable streams. Attainment of CWA objectives in Ohio is determined through the use of biologic indices developed by the Ohio Environmental Protection Agency (OEPA). Current levels of these indices within the project area are depressed well below values required to satisfy the CWA. Within the project area, there are elevated numbers of pollution-tolerant fish, dominated by carp and catfish species, with external physical anomalies. This occurs despite generally good water quality during normal flow conditions. Water quality standards are violated

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<sup>1</sup> River miles along the Mahoning River differ according to USACE and Ohio EPA designations. Table 1 lists the designations for various points within the study area.

during high flow events, suggesting the introduction of pollution during those times. Contaminated sediments along the banks within the project area have the potential of limiting riparian habitat. Further, early input for this study from the resource agencies indicated that, along with the contaminated sediments, the low-head dams limit the fishery potential of the river.

While there are still both point and non-point sources of pollution in the Mahoning River valley, relative to the prolonged and truly enormous contaminant loading that occurred during the region's previous industrial era, present loading is essentially negligible. For instance, as recently as 1977, the US Environmental Protection Agency Region V (Amendola, et al.) reported the average net discharge from the nine major Mahoning River valley steel plants exceeded 400,000 pounds per day (lbs/day) of suspended solids, 70,000 lbs/day of oil and grease, 9,000 lbs/day of ammonia-nitrogen, 500 lbs/day of cyanide, 600 lbs/day of phenolics, and 800 lbs/day of zinc. The oil discharge was equivalent to over 200 barrels per day, or the equivalent energy to heat nearly 30,000 average sized homes. To put these numbers in perspective, the million gallon Monongahela River Ashland oil spill of 1988 was characterized as one of the most severe inland oil spills in the nation's history. However, by comparison, the much smaller Mahoning River chronically received the equivalent of more than four Ashland oil spills every year for decades. Current levels of oil seeping into the Mahoning River are a minute fraction of the *historic quantities*.

Deposition of uncontrolled industrial era residue throughout the lower reach of the Mahoning River has resulted in the degradation of the aquatic ecosystem and has become a threat to public health. With the construction of low head water supply dams along the mainstem, oil/silt/contaminant mixtures, of almost pudding-like consistency, were trapped behind the dams. The extensive and highly effective upstream reservoir flood control system minimizes the high flows that would scour out and remove these materials.

A comprehensive biological assessment and a new sediment volume study were undertaken as part of this study to provide current, accurate information for consideration in forming restoration objectives and remedial alternatives. In addition, a comprehensive sampling program was undertaken to provide current, accurate information about the nature and extent of contamination of Mahoning River sediments.

The sediment quality sampling program was divided into four parts: a landfill profiling study; a vertical profiling study; a standard elution study; and a limited study to determine the extent of contaminated material contiguous to the existing river channel and lying under banks formed since construction of the low head dams. The sampling program was developed to address four questions: 1.) What are the principle chemical contaminants in the sediments? 2.) What would be the regulatory status of dredged sediments? 3.) Would dredging degrade water quality?, and 4.) Are contaminated sediments layered into high and low contamination zones or is the contamination distributed homogeneously?

The findings of this sampling program were:

- Mahoning River sediments are contaminated with organic chemicals and metals.
- Seriously contaminated strata of sediments in both the channel and bank areas can typically be identified by the presence of significant quantities of oil. However, there are no obvious horizons within the contaminated deposits to suggest varying degrees of contamination, and for practical removal and disposal purposes, they can be assumed to be unstratified.
- Contamination similar to that found in river channel sediments extends into depositional material under and into existing riverbanks. Evidence suggests that existing banks, which are underlain by contaminated material, are relatively recent depositional features within the original Mahoning River channel.
- Elutriate testing demonstrated that dredging activities would not release priority pollutants into the river. However, given the very high levels of petroleum compounds associated with these deposits, disturbances could release some oily substances to downstream waters. Therefore, best management practices would be necessary to minimize downstream migration of oily substances.

- Dredged sediments would not be contaminated enough to qualify as Hazardous Waste, but would require handling as a residual waste, and disposal would need to be accomplished in a secure, permitted landfill.

Complimenting this sampling program was a sediment survey throughout the project area to determine the volume of contaminated sediment within the project area. An earlier (1976) Corps of Engineers report was referenced to estimate contaminated material residing adjacent to the existing channel.

A Biologic Assessment conducted for this study concluded that there is a strong statistical correlation between sediment toxicity and the low levels of the OEPA biologic indices currently existing within the project area. This assessment concluded that the removal of toxic sediments would have a dramatic positive impact on these indices and would enhance both the invertebrate and fish communities. A further strong rationale for this conclusion is that contaminated sediments preclude the development of invertebrate populations vital to a quality food chain essential to healthy fish populations and are destructive to eggs deposited upon a toxic regime. The assessment also confirmed that removing the low-head dams would result in an increase of all biological indices.

As a result of this study, it has been determined that, in spite of the recent water quality improvements, the ecology of the Mahoning River cannot be expected to be restored until the contaminated sediments in the river and along the banks are remediated. Specific findings were:

- Contaminated sediments are the primary limiting factor hindering the biologic and aquatic recovery of the river and must be removed (dredged) if biological improvement is to be expected. There are approximately 462,000 cubic yards of contaminated riverbed sediments and 286,000 cubic yards of contaminated material along the shore. Remediation of contaminated sediments in place by capping rather than dredging was also considered as an alternative to dredging.
- Removal of some or all the dams would enhance biologic and aquatic recovery.
- Removal of the sediments by dredging and subsequent restoration of the river is technically feasible, meets the USACE's requirements for opportunities in Civil Works Programs, and is in the Federal interest.

Three restoration alternatives for the Mahoning River, including one that would cap contaminated sediments along the shore, were formulated and evaluated in consideration of these findings.

A preferred remedial alternative was selected based on two primary considerations; reliability of effectiveness in attaining the restoration objectives and the associated cost. The preferred alternative applies to the lower Mahoning River between River Mile 42.9 and River Mile 12 and includes the following features:

- 1) Dredge approximately seventy percent of the contaminated sediments from the river using hydraulic dredging equipment, and the remaining 30 percent using mechanical dredging equipment. Depending upon the method of execution, review under one or more of the following federal laws would be required: Section 10 of the River and Harbors Act; Section 404 of the Clean Water Act; Section 401 Water Quality Certification, and; the National Pollution Discharge Elimination System (NPDES).
- 2) Place the dredged sediment within holding basins underlain by gravel-lined drains. Drain water out the bottom of these basins, and pump from the top of the basins after the solids have settled out. Due to high level of petroleum contamination of the Mahoning River sediment, discharge to surface water would most likely require that carbon columns be added to an oil-water separator. Route the water from the holding basins through the oil-water separator and then return it to the Mahoning River. This arrangement would be expected to provide adequate dewatering of the sediments.
- 3) Dispose of the de-watered sediments at a permitted solid waste landfill.
- 4) Discharge from confined disposal areas to the Mahoning River would require both a NPDES permit and Permit to Install (PTI) from the Ohio EPA/Division of Surface Water. The OEPA would review and evaluate PTI requirements during the Section 401 water quality certification process.
- 5) Remove five of the nine dams. Modifications to other dams to enhance fish migration, such as fish ladders, would be considered in the feasibility phase.
- 6) Remove the contaminated material along the shore.
- 7) Handle and dispose of the excavated bank material in the same manner as the dredged sediments.

8) The ecosystem restoration would be accomplished almost entirely by the removal of highly contaminated, fine grain silty sediment deposits, and not from the removal of more ecologically important gravel and cobble substrates. About 275,000 cubic yards of clean gravel substrate used for roadbed fill as part of the dredging process would also be used to replace habitat disturbed during dredging.

The expected aquatic conditions after a remediation project closely mirror existing conditions of the Mahoning River between State Route 422 and the Leavittsburg Dam (approx. river miles 44.0 - 46.2). Conditions within the free-flowing reaches within the project area would be expected to resemble free-flowing reaches within the model area, whereas conditions within the pooled areas behind dams remaining in the project area would be expected to mirror the pooled reaches in the model area. The existing excellent and comprehensive OEPA Mahoning River monitoring program would support post project evaluation requirements to confirm these hypotheses.

The estimated cost of restoration for the entire project area is approximately 91 million dollars. Although not evaluated for this report, modifications to dams to enhance fish migration, such as fish ladders, could be incorporated where removal or breaching of the dams would result in significant costs to water withdrawers dependent upon existing pool levels. This restoration is expected to result in Mahoning River ecosystem restoration consistent with Ohio Environmental Protection Agency "Warm Water Habitat" standards in the project area.

Removal of contaminated material is expected to address local concerns by eliminating the swimming, wading, and sediment contact portions of the human health advisory. Contact advisories during combined sewer overflow and sanitary sewer overflow incidents would still probably be periodically necessary. Also, some fish consumption limitations would persist, especially for larger and older fish species with abundant fatty tissues (such as channel catfish and carp) that tend to accumulate PCBs and other organic chemicals. However, such limits would diminish after impacted generations of fish die off and for other fish

species that are less susceptible to accumulation of such harmful chemicals. Such moderated caveats, however, are common to important urban recreational waters across the nation, and should not diminish the projected economic benefits of a restoration project. Further, the potential for enhancing recovery of the fishery by replacing existing fish species with healthy populations, say by shock killing, natural recruitment, and/or restocking, would be evaluated in subsequent study stages.